

NERRS Estuaries 101 Middle School Curriculum
Activity 4: Estuary Food Pyramid
Next Generation Science Standards (NGSS) Alignment

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.</p> <ul style="list-style-type: none"> Develop a model to describe phenomena. (MS-LS2-3) <i>Students apply their skills by building an estuary food web with trophic levels showing how energy is lost and moved through a food web.</i> <p>Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.</p> <ul style="list-style-type: none"> Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-6) <i>Students, working in teams, generate their own models and generate brief responses to questions on their model; students working in teams or individually will read and discuss the report on climate change and phytoplankton.</i> [Climate Extension] <p>Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6) 	<p>LS1.C: Organization of Matter and Energy Flow in Organisms</p> <ul style="list-style-type: none"> Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6) <i>Students develop an understanding of this DCI through being introduced to producers, specifically plankton, and how they harness energy from the sun in photosynthesis adding energy to a food web. The creation of sugars for energy to be used or stored is not a focus of this exercise but could be expanded upon by the instructor.</i> <p>LS2.B: Cycles of Matter and Energy Transfer in Ecosystems</p> <ul style="list-style-type: none"> Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3) <i>Students explore producers, consumers, and decomposers; students build a food web using estuarine species; students learn about energy loss through a food web by including trophic levels in their webs. The cycle of atoms through the system between living and non-living parts is not expressly taught in this exercise but could be expanded upon by the instructor.</i> <p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <ul style="list-style-type: none"> Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4) 	<p>Energy and Matter</p> <ul style="list-style-type: none"> Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6) The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3) <i>Students construct and study estuarine food webs to learn how energy flows through the ecosystem.</i> <p>Stability and Change</p> <ul style="list-style-type: none"> Small changes in one part of a system might cause large changes in another part. (MS-LS2-4) <i>Students study how changes in climate will affect plankton numbers, which affects the entire oceanic food web.</i> [Climate Extension] <p>Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems</p> <ul style="list-style-type: none"> Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)

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	<i>Students discuss the effects of climate change on food webs and the amount of energy available if phytoplankton decreases. [Climate Extension]</i>	